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Enabling knowledge sharing

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Summary

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New Product Development (NPD) consortia become a more common form of organizing NPD activities. Organizing NPD in consortia brings challenges, because in the consortia specialized knowledge from multiple areas necessary for developing the new product is distributed across the participating organizations. To use and combine the specialized knowledge of the participating organizations, and combine it into a new product, knowledge sharing between the consortium members involved is crucial. The more effective project members share knowledge, the better they anticipate on interfaces, create new solutions and foresee problems. Effective knowledge sharing increases the probability the project members successfully complete their tasks and meet the quality, time and financial requirements. In other words, the way professionals share knowledge is crucial for NPD consortia. At the same time effective knowledge sharing is a real challenge for NPD consortia. This can result in a range of problems, from failure to meet quality requirements to budget and time schedule overruns. Some of these problems can likely be prevented by managing knowledge sharing more effectively. However, insight into the way knowledge sharing is enabled lacks both in practice and literature. The objective of this thesis is therefore to gain more insight into enablers that affect knowledge sharing in NPD consortia. Four enablers that shape the context in which knowledge is shared were the starting point for the current study: expertise overlap, co-location, involvement in multiple projects, and task dependency. The effects of these enablers on three knowledge sharing characteristics were studied: the reciprocity, frequency, and multiplexity of knowledge sharing. Additionally, the effects were studied at two levels of knowledge sharing: within teams (intra-team level) and between teams (inter-team level).

In this thesis we adopted a multi-theory social network analysis perspective to study knowledge sharing in NPD consortia. We examined how expertise overlap, co-location, task dependency and project involvement affect the reciprocity, frequency and multiplexity of knowledge sharing in pairs of team members and in pairs of teams. Adopting a multi-theory perspective, it was explored whether Transactive Memory theory, Social Exchange theory and Proximity have explanatory value for knowledge sharing in instrument consortia and the conditions under which the theories explain knowledge sharing. Moreover, distinguishing between the intra-team and inter-team level, similarities and differences between the effects of the enablers and the explanatory value of the theories at the two levels of knowledge sharing were studied.

From Transactive Memory theory, Social Exchange theory, and Proximity theory propositions were formulated for the effects of the enablers on the knowledge sharing characteristics. These propositions were tested in an empirical study conducted in two large NPD consortia in the field of space science, so called instrument consortia. In the one consortium a measurement instrument for a satellite is developed, in the other

consortium a network of antennas is developed. The propositions for the intra-team level were first tested in a quantitative study conducted through questionnaires in which 261 persons from 48 teams were included. The quantitative study was mainly conducted through questionnaires. Multilevel regression analyses were used for analyzing these data. The results form an answer to the first research question:

1. *What is the effect of expertise overlap, co-location, involvement in multiple projects and task dependency on the reciprocity, frequency and multiplexity of knowledge sharing within teams?*

The empirical findings show that task dependency is the main enabler for knowledge sharing within teams; it makes team members share knowledge more reciprocal, more frequently and on more content types. Co-location and expertise overlap are found to enable knowledge sharing, but their effect is less strong. If a team member is involved in multiple projects, he is less probable to share knowledge with a team member who is not involved in multiple projects. If these team members do share knowledge, it is less often but on more content types than when they are both involved in a single project. If two team members are both involved in multiple projects, they are more likely to share knowledge mutually. Furthermore, they are more probable to share knowledge frequently and on multiple contents.

The empirical findings for the intra-team level were used as a starting point for studying knowledge sharing at the inter-team level. In the empirical study at the inter-team level the emphasis was on exploring knowledge sharing between teams using a qualitative method. The qualitative study involved interviews with in total 34 team leaders of both consortia and four more structured and extensive interviews with key persons in the projects. The findings from the qualitative empirical study answer the second research question posed in this thesis:

2. *What is the effect of expertise overlap, co-location and task dependency on the reciprocity, frequency and multiplexity of knowledge sharing between teams?*

The empirical findings indicate that task dependency is the main enabler for knowledge sharing between teams. Task dependency has an enabling effect on reciprocity and frequency and focuses knowledge sharing on one or two content types. Expertise overlap and co-location also enable knowledge sharing between teams: both appear to increase the probability of mutual and more frequent knowledge sharing. A difference in areas of expertise seems to be related to more multiplex knowledge sharing and co-location appears to enable particular content types of knowledge (know how and know what) to be shared between teams.

The effects found in the quantitative and qualitative study were compared to the propositions formulated in the theoretical framework. By making the comparison, we were able to evaluate which theory best predicts the effects found and answer the third and fourth research question:

3. *Compared on explanatory strength, which theory best predicts the effects of enablers and knowledge sharing characteristics within teams?*

Findings indicate that the effects of expertise overlap and co-location within teams are best explained by Proximity theory. The effects of involvement in multiple projects are best explained by Social Exchange theory and the effects of task dependency are predicted by all three theories. Focusing on knowledge sharing characteristics explained, Proximity theory was found to be dominant in explaining knowledge sharing within teams. Transactive Memory theory has added value in explaining the number of contents shared. Social Exchange theory has added value in predicting the frequency of knowledge sharing in situations where the basic closeness between team members is very low.

4. *What is the effect of expertise overlap, co-location and task dependency on the reciprocity, frequency and multiplexity of knowledge sharing between teams?*

We found knowledge sharing between teams to be highly demand-driven. A combination of mechanisms as proposed by Transactive Memory theory and Proximity theory shapes the frequency and multiplexity of knowledge sharing between teams. The reciprocity of knowledge sharing appears to be best explained by Proximity theory. In our data Social Exchange theory offered no added value in explaining knowledge sharing between teams of instrument consortia.

Research question five and six cover the differences between the two levels of knowledge sharing studied. To answer these research questions empirical findings at the intra-team level and the inter-team level are compared on the effects of the enablers and on the theories that explain knowledge sharing.

5. *What are the differences between the intra-team level and inter-team level in the effects of enablers on knowledge sharing characteristics?*

Comparing the findings at both levels regarding the effects of the enablers on knowledge sharing characteristics, we found similarities as well as differences. Similar are the large enabling role of task dependency, the positive effect of co-location and the enabling effect of expertise overlap. Three differences are found for knowledge sharing within and between teams. First, where task dependency within teams leads to more content types shared, between teams it causes teams to be more focused on one or two content types. Second, within teams an overlap in expertise increases the likelihood of team members sharing knowledge mutually. Between teams an overlap in expertise is however found negatively affect the reciprocity of knowledge sharing. Third, an overlap in expertise between two team members was found to result in a tendency to share multiple contents types of knowledge. Between teams the opposite effect was found: an overlap in expertise decreases the likelihood teams share knowledge of multiple content types, whereas a difference in expertise causes the teams to share multiple content types of knowledge.

6. *Do the intra-team and inter-team level differ on the theories best explaining knowledge sharing?*

At both the intra-team and inter-team level, Proximity theory provides the most supported predictions of the effects of the enablers on knowledge sharing. Focusing on the knowledge sharing characteristics explained, there are however differences between the intra-team and inter-team level. A combination of mechanisms as proposed by Proximity theory, Social Exchange theory and Transactive Memory theory explained knowledge sharing within teams. We found that Social Exchange theory and Transactive Memory theory mainly have added value in explaining knowledge sharing in situations where the basic closeness between team members is low. Between teams our findings indicate differences. At the inter-team level mechanisms as proposed by Social Exchange theory do not seem to play any role in shaping knowledge sharing, and the role of Transactive Memory theory is much larger. Knowledge sharing between teams was explained by a combination of Transactive Memory and Proximity theory.